

DISCHARGE OF HIGH VOLTAGE LINES AND CAPACITORS BANKS THROUGH INDUCTIVE VOLTAGE TRANSFORMERS



In addition to the accurate measurement of the voltage on HV electricity networks, inductive voltage transformers can also be used to discharge high voltage trapped charges.

When opening the circuit breakers of an energized HV line and isolating it from earth, the voltage of this line is trapped in the high voltage conductors. This is a DC voltage.

This trapped DC voltage can cause overvoltages during the reconnection of the line. It can also cause insulation problems due to the polarization of insulating materials (for example the SF₆).

One of the most practical ways to eliminate these trapped charges in the line is to place an inductive voltage transformer. These inductive voltage transformers must be sized properly to withstand the mechanical stresses caused by the discharge current of the line through the primary winding of the transformer. We must also take into account the increase in the temperature of the primary coil when the discharge of the line occurs, because all the energy trapped in the line will be dissipated by the primary winding of the transformer, causing a substantial increase in the temperature of the winding.

Another interesting application is the discharge of capacitor banks. In the same way as with the lines, when a capacitor bank is disconnected, electric charges are trapped in the capacitor bank, causing a big accumulation of energy. This trapped DC voltage in the capacitor bank can cause overvoltage problems on high voltage equipment when reconnecting the capacitor bank. This can be easily avoided by using an inductive voltage transformer to discharge the capacitor bank.

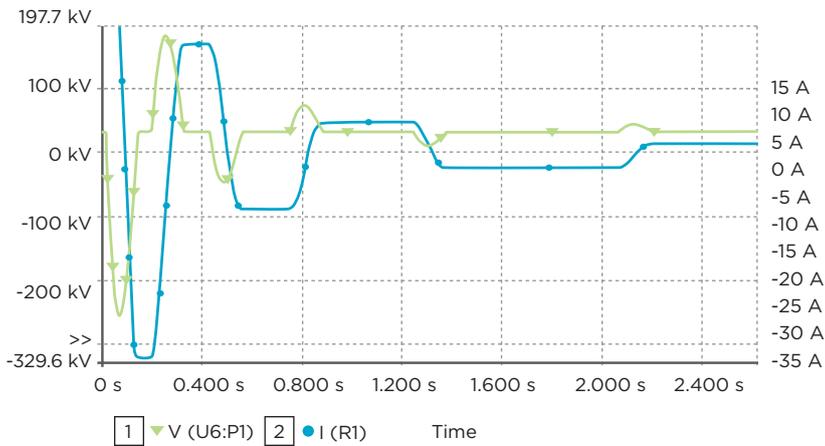
When discharging capacitor banks it is often an important requirement that the discharge is done quickly with the voltage reduced down to a few volts.

Another usual and important requirement in the case of capacitor banks is to enable a reconnection of the discharged capacitor bank within a short period of time. Normally the number of possible reconnections is limited to 2.



This number of reconnections is important because the heating of the primary winding of the transformer occurs very fast, and the time between two consecutive discharges is not long enough to allow the primary winding to dissipate all the energy. These successive discharges increase the heating of the primary winding of the inductive voltage transformer in a linear way, being the final temperature increase the addition of the temperature increases of both discharges.

The graphic shows a discharge of a HV line through an inductive voltage transformer. The blue line shows how the voltage (in kV) is reduced following an oscillating pattern. We can notice two different behaviours: one during the period of time when the core is saturated and another when the core is not saturated. In green we can see the current (in Amps) that appears during the discharge.



Inductive voltage transformers are built specifically to comply with these requirements. Therefore, they can dissipate the energy stored in HV lines and capacitor banks, thus protecting the insulation of HV equipment against overvoltages caused by the reconnection of these lines or capacitor banks with trapped charges. Simultaneously, inductive voltage transformers can provide a reliable and accurate voltage output that can be used both for measurement and protection.

Inductive voltage transformers can be used to discharge lines or capacitors banks at any voltage level, being the only limitation the amount of energy to discharge.

